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First records of *Faurelina* in the Neotropics

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Abstract—Two species of *Faurelina*, *F. fimigena* and *F. hispanica*, are recorded fruiting on herbivore dung collected in the Caatinga biome of the semi-arid region of Brazil. These represent the first records of this genus in the Neotropics. Descriptions, a photographic plate and a comparative table are provided, along with an identification key to the four species of *Faurelina*.

Key words—coprophilous fungi, *Didymellaceae*, non-ostiolate ascomycetes, *Pleosporales*

Introduction

Named after the French mycologist Louis Faurel (1907–73), *Faurelina* Locq.-Lin. was first described by Locquin-Linard (1975) as a new genus of cleistothecial ascomycetes. The genus has since had a problematic taxonomical history. At first *Faurelina* was tentatively placed in *Chadefaudiellaceae*, but this position was doubtful. *Chadefaudiellaceae* was validated by Benny & Kimbrough (1980), based on the suggestion by Faurel & Schotter, to include species with non-ostiolate immersed ascomata with a pseudoparenchymatous peridium and aerial thick-walled 'capillitium', enclosing catenulate, evanescent asci with non-dextrinoid ascospores devoid of germ pores (Cannon & Kirk 2007).

After examining the type species *Faurelina fimigena* [as *F. fimigenes*], Parguey-Leduc & Locquin-Linard (1976) stated that it belonged to the

ascolocular ascomycetes and concluded that it should be placed in the class formerly known as *Loculoascomycetes*. Two years later, von Arx (1978) transferred *Faurelina* to *Microascaceae* (*Microascales*), based mainly on the presence of dextrinoid ascospores without germ pores. Placement of *Faurelina* in *Microascales* was due in part to the work of Tang et al. (2007), who sequenced the nucLSU, nucSSU, and RPB2 gene regions from a single strain labelled as *Faurelina indica* (CBS 126.78), giving results identical to those of *Ceratocystis fimbriata*, the type species of *Ceratocystis* (*Microscales*). Réblová et al. (2011) reevaluated *Chadefaudiellaceae* based on the suggested affinity of *Faurelina indica* Arx et al. with *Microascales*; they believed that the material studied by Tang et al. (2007) was a different fungus and that the LSU sequence analysis suggested a relationship with *Didymellaceae* (*Pleosporales*, *Dothideomycetes*), thus corroborating the original hypothesis proposed by Parguey-Leduc & Locquin-Linard (1976), that *Faurelina* was related to fungi with an ascolocular development.

In Brazil, recent efforts to compile data on fungal diversity, distribution, and biogeography of fungi, include the discovery and delimitation of taxa in each biome and their substrate/climate relationship (Braga-Neto et al. 2013). This work contributes to these efforts in the semi-arid regions of South America by recording the discovery of an unreported genus in the Neotropics, represented by two species fruiting on herbivore dung in the Brazilian Caatinga biome.

Material & methods

Dung samples were collected from farms close to the Instituto Agronômico de Pernambuco (IPA) in Serra Talhada (7°54′59″S 38°17′00″W), in the semi-arid region of Pernambuco, Brazil. Fresh samples of goat, cattle, and horse dung were collected in clean plastic bags, taken to the laboratory, gently air dried when necessary, and incubated in moist chambers at room temperature (28 ± 2 °C) for at least 60 days under alternating natural light and dark periods. The specimen habit was observed directly from substrata under a Leica EZ4 stereomicroscope, and cleistothecia in different stages of maturation were mounted in tap water for measurements, description and identification under an Olympus BX51 compound microscope. High quality images were captured with a Qimaging QColor 3 digital camera mounted on an Olympus BX51 compound microscope using differential interference or phase contrast microscopy. Specimens were identified based on descriptions provided by Locquin-Linard (1975), Valldosera et al. (1987), and von Arx et al. (1988). Due to lack of material, no attempt was made to culture these specimens. Permanent slides were prepared with polyvinyl–lacto–glycerol (PVLG) and deposited at Herbarium Padre Camille Torrend, Departamento de Micologia, Universidade Federal de Pernambuco, Recife, Brazil (URM). Additional information regarding accessioned records, as well as photographic data can be accessed at the "INCT – Herbário Virtual da Flora e dos Fungos" database website (http://inct.florabrasil.net/).

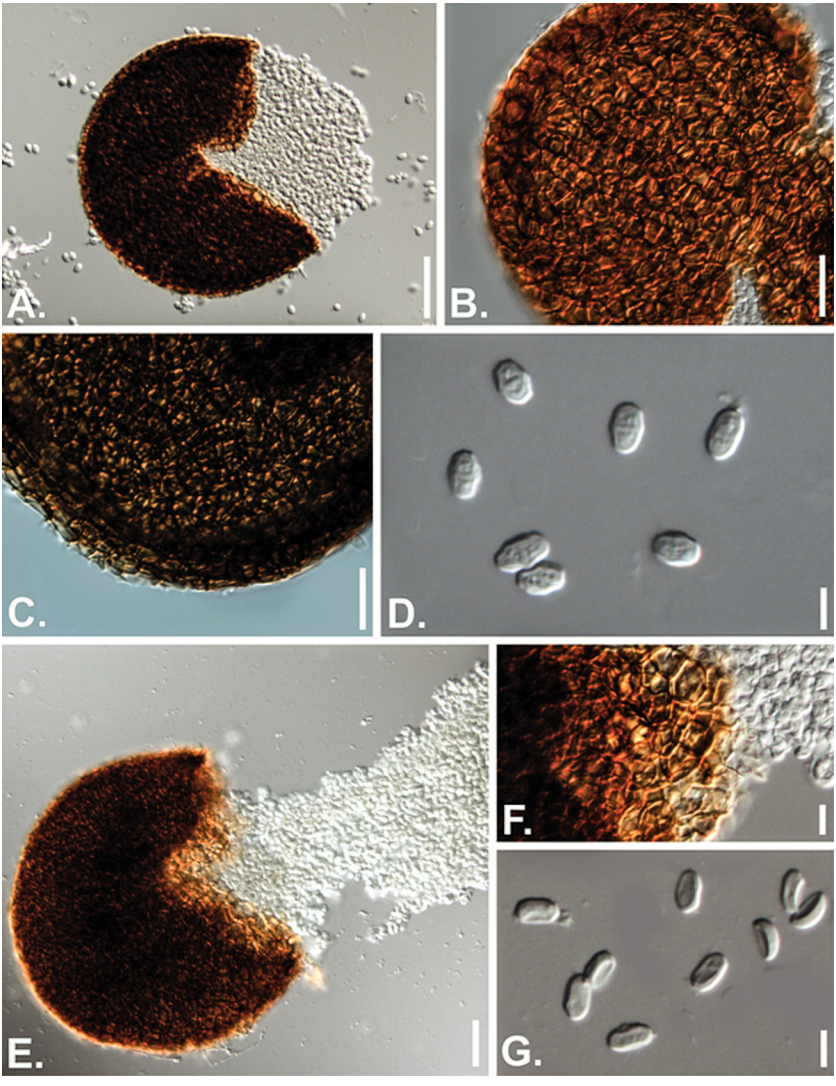

Figure 1. ***Faurelina fimigena*** (URM86671): A. cleistothecium in mountant, releasing mature ascospores; B, C. ascomatal wall; D. mature ascospores. ***Faurelina hispanica*** (URM86672): E. cleistothecium in mountant, releasing mature ascospores; F. ascomatal wall; G. mature ascospores. Scale bars: A = 50 µm; B, C = 25 µm; D = 7.5 µm; E = 30 µm; F, G = 5 µm.

Taxonomy

Faurelina fimigena Locq.-Lin., Rev. Mycol. (Paris) 39: 127 (1975) Fig. 1A–D

Cleistothecia immersed to superficial, solitary, globose to subglobose, dark red, 190–240 µm diam., with a roughened wall, glabrous. Ascomatal wall composed of inflated, globose to slightly angular stromatic cells (textura globulosa), thick-walled, rusty red to copper in color, 5–7.5 µm diam. Interascal elements not observed in the examined material. Asci 8-spored, globose to subglobose, often slightly clavate, 10–15.5 × 8–12.5 µm, occasionally with a short stipe, forming short chains during ascospore maturation, evanescent, irregularly biseriate. Ascospores variable in morphology, ellipsoid, rhomboid or angulated, with abrupt ends, hyaline to slightly pale brown when mature, one-celled, with longitudinal striae and furrows, thick-walled, 7.5–10 × 4.5–5.5 µm.

Material examined — **BRAZIL**. **Pernambuco**, Instituto Agronômico de Pernambuco (IPA), Serra Talhada, on cattle dung, 28.VIII.2012, R.F.R Melo (URM86671).

Habitat: Recorded on cattle and goat dung.

Distribution: Asia (India, Japan), Europe (France), South America (Brazil). This is the first record from South America.

Notes: *Faurelina fimigena* is the type species of the genus, described by Locquin-Linard from material obtained in Paris. Although the records are scarce making it difficult to delimit the species, it differs from the other *Faurelina* species by ascospore shape and size. The ascospores in the Brazilian material are longer than those cited in the original description but are similar to the specimens analyzed by von Arx et al. (1988) obtained from subcultures of the type material. *Faurelina fimigena* resembles *F. elongata* (Udagawa & Furuya) Furuya [≡ *Leuconeurospora elongata* Udagawa & Furuya], and there has been some confusion in the delimitation of these species. However, *F. fimigena* differs from *F. elongata* in ascospore length.

Faurelina hispanica Valldos. & Guarro, Mycotaxon 30: 5 (1987) Fig. 1E–G

Cleistothecia immersed to superficial, solitary, globose, dark red, 195–210 µm diam., glabrous. Ascomatal wall composed of inflated, globose to slightly angled stromatic cells (textura globulosa), thick-walled, rusty red to copper in color, 5–10 µm diam. Interascal elements not observed in the examined material. Asci 8-spored, clavate to cylindrical-clavate, 11–12.5 × 5–9.5 µm, occasionally with a short stipe, forming short chains during ascospore maturation, evanescent, irregularly biseriate. Ascospores ellipsoidal to oblong, with rounded ends, hyaline to slightly pale brown when

Table 1. Synopsis of diagnostic characters in *Faurelina*

Species	Cleistothecia	Peridium	Ascospores	Conidia
F. elongata	Vertically elongated, 300–360 µm diam.	Cephalothecoid; cells thick-walled, angular	Fusiform to ellipsoidal, 5–7 × 3.5–4.5 µm	Absent or not observed
F. fimigena	Globose to subglobose, wall roughened; 190–240 µm diam.	Non-cephalothecoid; cells globose inflated, thick-walled, rusty red to copper in color, 5–7.5 µm diam.	Ellipsoidal, rhomboidal or angular, with abrupt ends, longitudinally striate and furrowed; thick-walled, 7.5–10 × 4.5–5.5 µm.	Absent or not observed
F. hispanica	Globose, 195–210 µm diam.	Non-cephalothecoid; cells globose inflated, thick-walled, rusty red to copper in color, 5–10 µm diam.	Ellipsoidal to oblong, with rounded ends, longitudinally striate, 5–6 × 2.5–3 µm	Absent or not observed
F. indica	Hemispherical or pustulate, rounded above, 170–300 × 180–250 µm	Non-cephalothecoid; cells thick-walled, in vertical rows, elongate, 5–7 µm diam.	Fusiform-navicular or rhomboidal, with some furrows, finely striated by irregular, usually longitudinal thickenings, 6–8 × 4–5.5 µm	Arthroconidia, 1–2-celled, hyaline, with truncate ends

mature, one-celled, with longitudinal striations, 5–6 × 2.5–3 µm in frontal view, 2–2.5 µm wide in side view.

Material examined:— **BRAZIL. Pernambuco**: Instituto Agronômico de Pernambuco (IPA), Serra Talhada, in horse dung, 14.II.2013, R.F.R Melo s.n. (URM86672).

Habitat: Recorded on goat dung.

Distribution: Europe (Spain), South America (Brazil). This is the first record from South America.

Notes: *Faurelina hispanica* was described by Valldosera et al. (1987) and distinguished from *F. fimigena* by its smaller ascospores with rounded ends.

Key to species of *Faurelina*

1. Peridium cephalothecoid; ascomata vertically elongate ..... *F. elongata*
Peridium not cephalothecoid; ascomata globose to subglobose 2

2. Conidial state with cylindrical, 0–1-septate arthroconidia; ascospores fusiform–navicular ..... *F. indica*
Conidial state absent or otherwise; ascospores ellipsoidal 3

3. Ascospores 7.5–10 × 4.5–5.5 µm, irregular in shape, abruptly angular, with tapered ends ..... *F. fimigena*
Ascospores 5–6 × 2.5–3 µm, regular in shape, phaseoliform to ellipsoidal, with rounded ends ..... *F. hispanica*

Discussion

This study is the first to report *Faurelina* from the Neotropics, expanding its biogeographical distribution. Both species recorded in Brazil are morphologically very similar to the original European descriptions. The other two *Faurelina* species (not yet known from Brazil) were described from Asia: *F. elongata* from Kagoshima (southwestern Kyushu, Japan) and *F. indica* from Delhi (India), both fruiting on herbivore dung.

It is noteworthy that despite the relatively small number of records of this genus worldwide, two *Faurelina* species were recorded in a semi-arid biome. Conservation issues regarding Brazilian semi-arid diversity present a great challenge to taxonomists for a number of reasons, the most significant of which is that with approximately 98% of its territory outside conservation areas, the semi-arid is the least protected natural area in Brazil and suffers from environmental degradation caused by unsustainable use of its natural resources (Leal et al. 2003). Conservation is a major concern of mycologists in the 21st century, who are aware of the significant decline of natural habitats (Moore et al. 2001). The biological diversity in the Caatinga biome is high in relation to what was previously believed. The lack of knowledge about fungal diversity, especially coprophilous fungi, is an important factor that complicates conservation strategies. The focused study of herbivore dung mycobiota can improve the knowledge of the biogeography and diversity of many unreported species.

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